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Spontaneous symmetry breaking and a boundary value problem for the proximity effect in ferromagnet/superconductor nanostructures

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Abstract

A three-dimensional (3D) boundary value problem for the Eilenberger function has been microscopically derived. It is applicable for describing the proximity effect in ferromagnet/superconductor (F/S) nanostructures, where the superconductivity is the superposition of the BCS pairing with zero total momentum in the S layers and the pairing through the Larkin-Ovchinnikov-Fulde-Ferrell (LOFF) mechanism with nonzero 3D momentum of pairs k in the F layers. It has been shown that continuous matching at the F/S interface occurs only for the pair amplitudes with the same space symmetry. When two pairing types are simultaneously present, the processes of mutual transformations between LOFF and BCS pairs at the F/S interface occur as Umklapp processes through surface states. The phase diagrams of the surface states with the mixed BCS + LOFF pairing type have been analyzed. Superconductivity localized at the F/S interface has been predicted. © Pleiades Publishing, Ltd., 2009.

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